



wwPDB X-ray Structure Validation Summary Report ⓘ

May 26, 2020 – 11:57 am BST

PDB ID : 5C9I
Title : Structure of N-acylhomoserine lactone acylase MacQ shortened spacer mutant (delta202-208) in uncleaved form
Authors : Yasutake, Y.; Kusada, H.; Kimura, N.
Deposited on : 2015-06-27
Resolution : 1.80 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

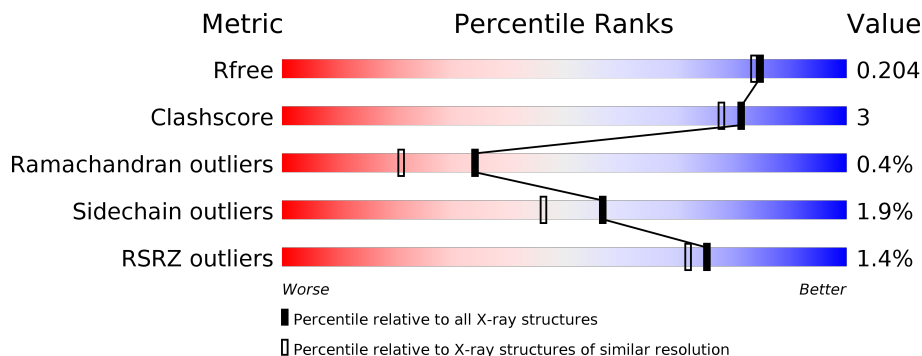
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	779	
1	B	779	
1	C	779	
1	D	779	

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 25397 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Protein related to penicillin acylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	768	5841	3662	1044	1110	25	0	3	0
1	B	762	5806	3643	1032	1105	26	0	4	0
1	C	751	5705	3576	1018	1086	25	0	1	0
1	D	746	5674	3560	1012	1077	25	0	1	0

There are 88 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	5	SER	-	expression tag	UNP A0A0A1VBK6
A	6	GLY	-	expression tag	UNP A0A0A1VBK6
A	7	GLY	-	expression tag	UNP A0A0A1VBK6
A	8	GLY	-	expression tag	UNP A0A0A1VBK6
A	9	ASP	-	expression tag	UNP A0A0A1VBK6
A	10	GLY	-	expression tag	UNP A0A0A1VBK6
A	11	SER	-	expression tag	UNP A0A0A1VBK6
A	?	-	VAL	deletion	UNP A0A0A1VBK6
A	?	-	GLY	deletion	UNP A0A0A1VBK6
A	?	-	GLY	deletion	UNP A0A0A1VBK6
A	?	-	GLU	deletion	UNP A0A0A1VBK6
A	?	-	LEU	deletion	UNP A0A0A1VBK6
A	?	-	GLY	deletion	UNP A0A0A1VBK6
A	?	-	VAL	deletion	UNP A0A0A1VBK6
A	776	LEU	-	expression tag	UNP A0A0A1VBK6
A	777	GLU	-	expression tag	UNP A0A0A1VBK6
A	778	HIS	-	expression tag	UNP A0A0A1VBK6
A	779	HIS	-	expression tag	UNP A0A0A1VBK6
A	780	HIS	-	expression tag	UNP A0A0A1VBK6
A	781	HIS	-	expression tag	UNP A0A0A1VBK6
A	782	HIS	-	expression tag	UNP A0A0A1VBK6

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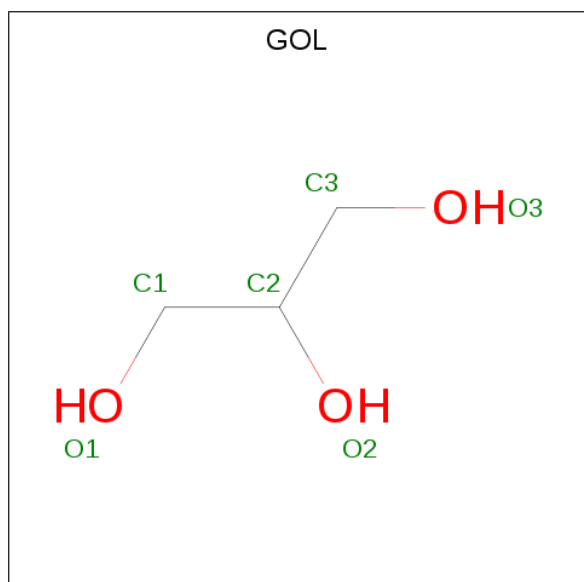
Chain	Residue	Modelled	Actual	Comment	Reference
A	783	HIS	-	expression tag	UNP A0A0A1VBK6
B	5	SER	-	expression tag	UNP A0A0A1VBK6
B	6	GLY	-	expression tag	UNP A0A0A1VBK6
B	7	GLY	-	expression tag	UNP A0A0A1VBK6
B	8	GLY	-	expression tag	UNP A0A0A1VBK6
B	9	ASP	-	expression tag	UNP A0A0A1VBK6
B	10	GLY	-	expression tag	UNP A0A0A1VBK6
B	11	SER	-	expression tag	UNP A0A0A1VBK6
B	?	-	VAL	deletion	UNP A0A0A1VBK6
B	?	-	GLY	deletion	UNP A0A0A1VBK6
B	?	-	GLY	deletion	UNP A0A0A1VBK6
B	?	-	GLU	deletion	UNP A0A0A1VBK6
B	?	-	LEU	deletion	UNP A0A0A1VBK6
B	?	-	GLY	deletion	UNP A0A0A1VBK6
B	?	-	VAL	deletion	UNP A0A0A1VBK6
B	776	LEU	-	expression tag	UNP A0A0A1VBK6
B	777	GLU	-	expression tag	UNP A0A0A1VBK6
B	778	HIS	-	expression tag	UNP A0A0A1VBK6
B	779	HIS	-	expression tag	UNP A0A0A1VBK6
B	780	HIS	-	expression tag	UNP A0A0A1VBK6
B	781	HIS	-	expression tag	UNP A0A0A1VBK6
B	782	HIS	-	expression tag	UNP A0A0A1VBK6
B	783	HIS	-	expression tag	UNP A0A0A1VBK6
C	5	SER	-	expression tag	UNP A0A0A1VBK6
C	6	GLY	-	expression tag	UNP A0A0A1VBK6
C	7	GLY	-	expression tag	UNP A0A0A1VBK6
C	8	GLY	-	expression tag	UNP A0A0A1VBK6
C	9	ASP	-	expression tag	UNP A0A0A1VBK6
C	10	GLY	-	expression tag	UNP A0A0A1VBK6
C	11	SER	-	expression tag	UNP A0A0A1VBK6
C	?	-	VAL	deletion	UNP A0A0A1VBK6
C	?	-	GLY	deletion	UNP A0A0A1VBK6
C	?	-	GLY	deletion	UNP A0A0A1VBK6
C	?	-	GLU	deletion	UNP A0A0A1VBK6
C	?	-	LEU	deletion	UNP A0A0A1VBK6
C	?	-	GLY	deletion	UNP A0A0A1VBK6
C	?	-	VAL	deletion	UNP A0A0A1VBK6
C	776	LEU	-	expression tag	UNP A0A0A1VBK6
C	777	GLU	-	expression tag	UNP A0A0A1VBK6
C	778	HIS	-	expression tag	UNP A0A0A1VBK6
C	779	HIS	-	expression tag	UNP A0A0A1VBK6
C	780	HIS	-	expression tag	UNP A0A0A1VBK6

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Chain	Residue	Modelled	Actual	Comment	Reference
C	781	HIS	-	expression tag	UNP A0A0A1VBK6
C	782	HIS	-	expression tag	UNP A0A0A1VBK6
C	783	HIS	-	expression tag	UNP A0A0A1VBK6
D	5	SER	-	expression tag	UNP A0A0A1VBK6
D	6	GLY	-	expression tag	UNP A0A0A1VBK6
D	7	GLY	-	expression tag	UNP A0A0A1VBK6
D	8	GLY	-	expression tag	UNP A0A0A1VBK6
D	9	ASP	-	expression tag	UNP A0A0A1VBK6
D	10	GLY	-	expression tag	UNP A0A0A1VBK6
D	11	SER	-	expression tag	UNP A0A0A1VBK6
D	?	-	VAL	deletion	UNP A0A0A1VBK6
D	?	-	GLY	deletion	UNP A0A0A1VBK6
D	?	-	GLY	deletion	UNP A0A0A1VBK6
D	?	-	GLU	deletion	UNP A0A0A1VBK6
D	?	-	LEU	deletion	UNP A0A0A1VBK6
D	?	-	GLY	deletion	UNP A0A0A1VBK6
D	?	-	VAL	deletion	UNP A0A0A1VBK6
D	776	LEU	-	expression tag	UNP A0A0A1VBK6
D	777	GLU	-	expression tag	UNP A0A0A1VBK6
D	778	HIS	-	expression tag	UNP A0A0A1VBK6
D	779	HIS	-	expression tag	UNP A0A0A1VBK6
D	780	HIS	-	expression tag	UNP A0A0A1VBK6
D	781	HIS	-	expression tag	UNP A0A0A1VBK6
D	782	HIS	-	expression tag	UNP A0A0A1VBK6
D	783	HIS	-	expression tag	UNP A0A0A1VBK6

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		

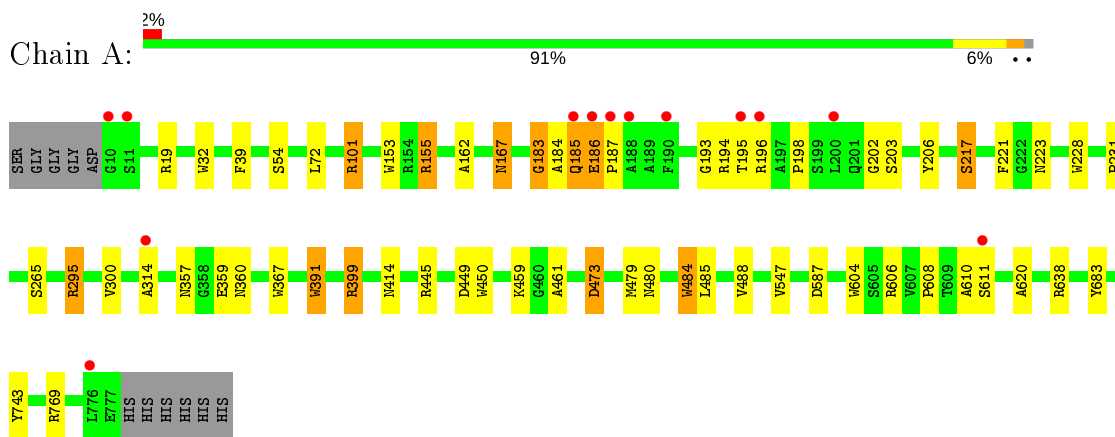
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	658	Total	O	0	0
			658	658		
3	B	636	Total	O	0	0
			636	636		
3	C	518	Total	O	0	0
			518	518		
3	D	553	Total	O	0	0
			553	553		

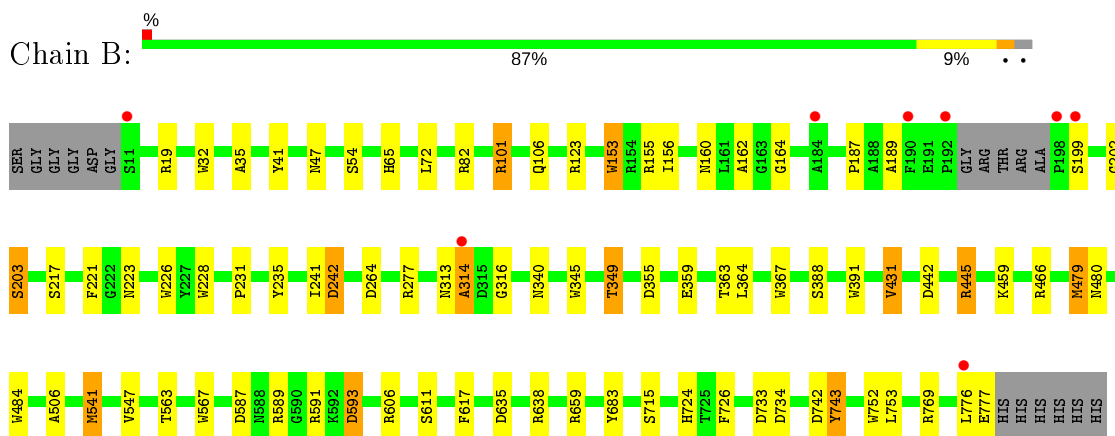
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

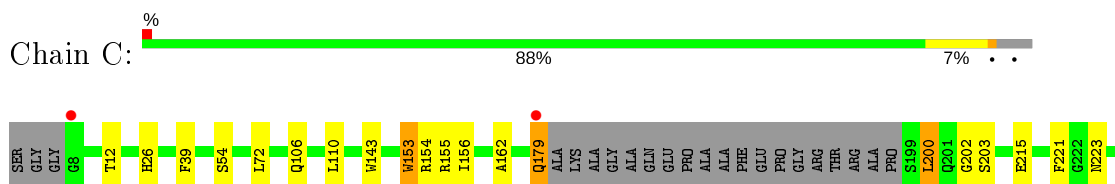
- Molecule 1: Protein related to penicillin acylase



- Molecule 1: Protein related to penicillin acylase

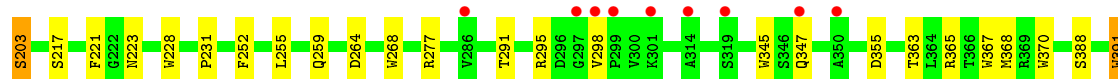
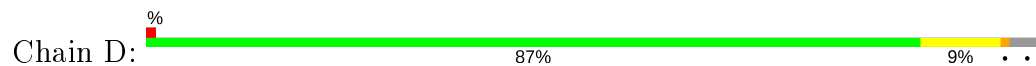


- Molecule 1: Protein related to penicillin acylase





• Molecule 1: Protein related to penicillin acylase



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4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	102.72Å 137.77Å 121.52Å 90.00° 111.45° 90.00°	Depositor
Resolution (Å)	50.00 – 1.80 48.05 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.8 (50.00-1.80) 99.9 (48.05-1.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.12	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.52 (at 1.79Å)	Xtrriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.166 , 0.206 0.164 , 0.204	Depositor DCC
R_{free} test set	14559 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	18.4	Xtrriage
Anisotropy	0.264	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 43.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	25397	wwPDB-VP
Average B, all atoms (Å ²)	21.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.74% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section:
GOL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	1.09	9/5997 (0.2%)	1.00	15/8168 (0.2%)
1	B	1.11	12/5964 (0.2%)	1.03	21/8121 (0.3%)
1	C	1.02	11/5853 (0.2%)	0.95	14/7970 (0.2%)
1	D	1.08	14/5822 (0.2%)	0.98	19/7929 (0.2%)
All	All	1.07	46/23636 (0.2%)	0.99	69/32188 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	3
All	All	0	4

The worst 5 of 46 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	752	TRP	CD2-CE2	8.40	1.51	1.41
1	B	593	ASP	CB-CG	8.14	1.68	1.51
1	D	450	TRP	CD2-CE2	7.20	1.50	1.41
1	B	228	TRP	CD2-CE2	7.12	1.49	1.41
1	D	567	TRP	CD2-CE2	7.06	1.49	1.41

The worst 5 of 69 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	541	MET	CG-SD-CE	-14.40	77.16	100.20
1	A	295	ARG	NE-CZ-NH2	-10.08	115.26	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	264	ASP	CB-CG-OD1	8.58	126.02	118.30
1	B	466	ARG	NE-CZ-NH2	-8.36	116.12	120.30
1	C	277	ARG	NE-CZ-NH2	-8.22	116.19	120.30

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	183	GLY	Peptide
1	B	199	SER	Peptide
1	B	313	ASN	Peptide
1	B	314	ALA	Peptide

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5841	0	5582	30	0
1	B	5806	0	5544	35	0
1	C	5705	0	5442	30	0
1	D	5674	0	5419	29	0
2	A	6	0	8	0	0
3	A	658	0	0	3	0
3	B	636	0	0	7	0
3	C	518	0	0	2	0
3	D	553	0	0	4	0
All	All	25397	0	21995	119	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

The worst 5 of 119 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:185:GLN:O	1:A:186:GLU:HG2	1.63	0.97

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:179:GLN:HA	1:C:179:GLN:OE1	1.63	0.95
1:A:185:GLN:HE21	1:A:185:GLN:HA	1.35	0.91
1:A:202:GLY:O	1:A:480[A]:ASN:ND2	2.10	0.85
1:B:563:THR:HG23	3:B:1262:HOH:O	1.79	0.82

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	769/779 (99%)	739 (96%)	26 (3%)	4 (0%)	29	15
1	B	762/779 (98%)	730 (96%)	28 (4%)	4 (0%)	29	15
1	C	748/779 (96%)	716 (96%)	30 (4%)	2 (0%)	41	27
1	D	743/779 (95%)	715 (96%)	26 (4%)	2 (0%)	41	27
All	All	3022/3116 (97%)	2900 (96%)	110 (4%)	12 (0%)	34	21

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	184	ALA
1	A	187	PRO
1	B	314	ALA
1	A	203	SER
1	A	314	ALA

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	590/595 (99%)	579 (98%)	11 (2%)	57	46
1	B	588/595 (99%)	577 (98%)	11 (2%)	57	46
1	C	578/595 (97%)	564 (98%)	14 (2%)	49	36
1	D	575/595 (97%)	568 (99%)	7 (1%)	71	65
All	All	2331/2380 (98%)	2288 (98%)	43 (2%)	57	48

5 of 43 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	611	SER
1	C	155	ARG
1	D	298	VAL
1	B	743	TYR
1	B	769	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	185	GLN
1	B	65	HIS
1	B	176	GLN
1	D	160	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	GOL	A	801	-	5,5,5	0.20	0	5,5,5	1.19	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	A	801	-	-	1/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	801	GOL	O1-C1-C2-O2

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	768/779 (98%)	-0.62	13 (1%) 70 66	11, 17, 34, 66	0
1	B	762/779 (97%)	-0.65	8 (1%) 82 80	11, 17, 31, 88	0
1	C	751/779 (96%)	-0.45	9 (1%) 79 76	12, 20, 46, 74	0
1	D	746/779 (95%)	-0.50	11 (1%) 73 70	11, 19, 42, 64	0
All	All	3027/3116 (97%)	-0.56	41 (1%) 75 72	11, 18, 40, 88	0

The worst 5 of 41 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	198	PRO	6.5
1	B	192	PRO	5.7
1	A	11	SER	4.5
1	B	314	ALA	4.4
1	C	179	GLN	4.3

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	GOL	A	801	6/6	0.96	0.08	26,29,32,34	0

6.5 Other polymers [i](#)

There are no such residues in this entry.